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Author: Agnieszka Działuk, Dariusz Malczewski, Jerzy Żaba, Maria Dziurawicz

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Laboratory measurements of natural radioactivity in selected igneous rocks of the Opava Mountains region

Agnieszka Dżaluk¹, Dariusz Malczewski¹, Jerzy Żaba², Maria Dziurawicz¹

¹ University of Silesia, Faculty of Earth Sciences, Department of Applied Geology; ul. Będzińska 60, 41-200 Sosnowiec, Poland; e-mail: agnieszka.dzaluk@gmail.com, dariusz.malczewski@us.edu.pl, maria.dziurawicz@us.edu.pl

² University of Silesia, Faculty of Earth Sciences, Department of Fundamental Geology; ul. Będzińska 60, 41-200 Sosnowiec, Poland; e-mail: jerzy.zaba@us.edu.pl

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The paper presents the results of the laboratory gamma-ray measurements of six igneous rocks from the Opava Mountains. The Opava Mountains are located in the Eastern Sudetes and represent their furthest eastern range. They run almost latitudinally along the Polish border with the Czech Republic. The Opava Mountains are mostly situated in the Czech Republic. Only a small fragment between Głucholazy in the west and Prudnik in the east is situated in Poland (Janeczek et al. 1991). The study area is built of rocks of different ages and lithologies. The Opava Mountains belong to the western part of the Upper Silesia Block, which together with the Brno Block form a structure that is called the Brunovistulicum. The mountains consist of five structural stages: the Žulova Massif, the Desna Series, the Vrbno Series, the Andělská-Hora Formation and the Horn-Benešov Formation, which run longitudinally (Žaba et al. 2005). The activities of naturally occurring radionuclides were measured using a portable GX3020 gamma-ray workstation. The system is based on a high-purity germanium (HPGe) detector with a 32% relative efficiency and energy resolutions of 0.8 keV at 122 keV and 1.7 keV at 1330 keV. The activity concentrations of ⁴⁰K varied from 519 Bq·kg⁻¹ (paragneiss, Głucholazy/Mikulice) to 1559 Bq·kg⁻¹ (weathered granite, Sławniowice), while those of ²²⁸Ac (²³²Th series) from 7.2 Bq·kg⁻¹ (weathered granite, Sławniowice) to 70.6 Bq·kg⁻¹ (migmatitic gneiss, Nadziejów). The activities that were associated with ²²⁶Ra (²³⁸U series) ranged from

5.5 Bq·kg⁻¹ (weathered granite, Sławniowice) to 52.2 Bq·kg⁻¹ (gneiss, Kamienna Góra). The measured activity concentrations were compared with the average activity concentration of ⁴⁰K, ²²⁸Ac (²³²Th) and ²²⁶Ra (²³⁸U) for similar types of rocks reported in the world specialist literature. The average value of the activity concentrations of ⁴⁰K for granites and gneisses equals 1000 Bq·kg⁻¹ (Van Schmus 1995, Eisenbud & Gesell 1997), which means that the measured value of granite in the Sławniowice quarry is significantly higher than the average one, whereas the activity concentration of paragneiss is almost two times lower than the average value of similar types of rocks. The activity concentrations of ²²⁸Ac (²³²Th) and ²²⁶Ra (²³⁸U) in measured rocks are comparable to the average values (70 Bq·kg⁻¹ and 40 Bq·kg⁻¹ respectively (Van Schmus 1995, Eisenbud & Gesell 1997). Only the activity concentrations of granite in the Sławniowice quarry are considerably lower than the average values for the typical ones because it is strongly weathered. The aim of this paper is to show the first experimental data concerning the activity concentrations of primordial radionuclides in the igneous rocks in the Opava Mountains.

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